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DISCUSSION AND CORRESPONDENCE

A NEW TOY MOTOR

I MADE of wood a nacelle about two inches long, pointed at one end and open at the other, shaped like a skiff without a sternboard. It was rendered water-repellent by a slight coating of paraffin. A slice of soap was fitted into the stern and the boat thus completed was placed on still water in a bath tub. As was anticipated, the craft began to move off as soon as the water came in contact with the soap. After gathering way it reached a velocity of a couple of inches per second. Sometimes the course was nearly straight, sometimes erratic, as might have been expected in the absence of steering apparatus.

The power is derived from the potential energy of the surface water-film set free by the diminution of surface tension, this reduction being due to solution of the soap.

If the whole immersed surface of the boat is allowed to become soapy, converse conditions set in. The boat is then approximately in stable equilibrium in the center of an area of low surface tension and, if displaced by a half an inch or so, may return to its place almost as if anchored.

It seems *a priori* improbable that the means of locomotion illustrated by this little motorboat has not been utilized in nature. If, for example, the ripe seeds of a plant growing in shallow, still water were boat-shaped and provided with a store of soluble material at the blunt ends, they might attain a much wider dissemination or more varied environment than that open to similar seeds not fitted to utilize the potential energy of surface tension.

I am not aware that such seeds have been described, but my acquaintance with botanical literature is of the slightest. If the facts are already known this note may assist to diffuse a knowledge of them.

GEORGE F. BECKER

WASHINGTON, D. C.,
October 27, 1911

A COMMON ERROR CONCERNING CECIDIA

IT is well known that many errors which are recognized by scientific workers are repeated in various publications, including text-books, until they threaten to become as thoroughly engrafted into our literature as the George Washington hatchet and cherry-tree story, although not nearly so useful. Among these errors is the prevailing opinion that vegetable galls which are due to insects are the result of an irritating fluid secreted by the female parent insect at the time of ovipositing. Many of our scientists cling to this ancient theory as tenaciously as the young American clings to the wonderful hatchet story.

The latest outbreak is in the recent edition of the Encyclopædia Britannica, in which, under the heading "Galls," it is said that "The exciting cause of the hypertrophy, in the case of typical galls, appear to be a minute quantity of some irritating fluid or virus, secreted by the female insect, and deposited with her egg in the puncture made by her ovipositor in the cortical or foliaceous parts of plants. This virus causes the rapid enlargement and subdivision of the cells affected by it, so as to form the tissues of the gall. Oval or larval irritation also, without doubt, play an important part in the formation of many galls."

In consideration of this prevailing idea it may be worth while to review our knowledge on this point. This theory was first advanced by Malpighi in his "De Gallis" (1686), who believed that the female parent secreted a poison when she deposited the egg and that this caused a fermentation of the plant acid which stimulated the plant cells and thus caused the gall. This theory was repeated almost without question until the latter part of the last century; Réaumur accepted it but thought that the egg might have some thermal effect and that the character of the wound might also be a factor; Dr. Derham said it might be "partly due to the act of the plant, and partly to some virulency in the juice or egg, or both, deposited in the vegetable by the parent animal; and just as this virulency is various according to the difference of its animal, so is the form and texture of the gall excited thereby"; Darwin expressed the opinion that galls were caused "by a minute atom

of the poison of the gall insect"; and Sir James Paget as late as 1880 said that "the most reasonable, if not the only reasonable theory, is that each insect infects or inoculates the leaf or other structure of the chosen plant with a poison peculiar to itself." In brief, the theory of a stimulus due to a chemical substance injected into the plant by the female at time of egg laying was the accepted view of scientists from the publication of Malphighi's "De Gallis" in 1686 until about thirty years ago. However, from about 1877 to 1882 there appeared a number of important publications by Dr. Hermann Adler and Dr. M. W. Beyerinck which in a great part disproved the previously almost undisputed theory. From this time the study of cecidology became a growing factor in plant physiology and plant pathology.

Beyerinck's work indicated that the fluid injected by mother insect was tasteless and odorless and not perceptibly irritating when injected under the skin and that it probably served only as an antiseptic dressing to the wound of the host plant. The work of both authors indicated that there was no cell activity on the part of the host plant leading to gall formation until the larvæ emerged from the egg. Adler, as a result of a careful study of the galls of *Neuroterus læviusculus* and *Biorhiza aptera,* states that immediately following the emerging of the larvæ from the egg that there is a rapid division of the cells of the host plant due to the attacks of the larvæ. He was inclined to believe this due to the influence of salivary excretions. However, Adler also made a study of the Galls of *Nematus vallisnierii* on *Salix amygdalina,* which is produced immediately following oviposition and is fully developed before the hatching of the larvæ. This is probably the only well authenticated case of gall formation previous to the hatching of the larvæ and is undoubtedly the exception rather than the rule for gall builders.

It is well known that the gall makers belonging to the Cecidomyidæ, Aphididæ and Acarina do not puncture the plant tissues with the ovipositors and that the young insects are, strictly speaking, never within the tissues of the host plant but are surrounded by plant growths due to an irritation by their own mouth parts.

At the present time there is no proof, except in the case of *Nematus vallisnierii* that the gall is due to a secretion from the mother insect. Whether due to a chemical or a mechanical irritation of the young insect are questions with as much circumstantial evidence for the one as for the other.

It may be added that the studies of the past few years on cecidia due to bacteria, myxomycetes, fungi and nematodes indicate certain striking resemblances to the zoo-cecidia and we have reason to believe that further researches into the anatomy and physiology of these various groups of hypertrophied structures will lead to valuable contributions to our knowledge of cecidology.

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The Air-bladder of the Clupeoid Fishes

In a recent letter (Science, October 13) Dr. E. C. Starks has suggested that the posterior opening of the air-bladder in *Clupea harengus* needs further investigation. This opening was originally described by Weber in 1820, was rediscovered by Bennett in 1880, and was again described by Dr. Ridewood in 1892 in a paper entitled "The Air-bladder and Ear of British Clupeoid Fishes" (*Journ. Anat. Phys.,* XXVI., pp. 26–42). Dr. Ridewood devoted a special section to the posterior opening to the exterior; he showed that it was present not only in *Clupea harengus,* but in *C. pilchardus, C. sprattus, C. alosa* and *Engraulis encrasicholus.* In *Clupea finta,* however, he found that the air-bladder tapered to a point posteriorly and did not open to the exterior.

C. Tate Regan

British Museum (Natural History),
London, S. W.,
October 30